GOA Trial Site Report

Wheat - improving confidence in high plant populations as a weed control tool in lower rainfall environments.

Trial Code:	**GOWE06320-2**
Season/Year:	Winter 2020
Location:	'Wilga Park', Lake Cargelligo
Collaborators:	Andrew McFadyen

Keywords

GOWE063, Wheat, plant populations, competition, varieties

Take home messages

Increasing sowing rates increased resultant crop populations and assumedly weed competition, varieties that reached peak biomass earlier may be better choices in paddocks where weeds are a problem.

Increasing sowing rates and crop populations generally did not negatively impact yields

Increasing sowing rates and crop populations generally did not result in higher screenings.

Background

The improvement in weed management through enhancing crop competitiveness through decreasing row spacing and increasing plant populations is well documented. However, a key barrier to adoption, particularly in marginal yield/ rainfall environments, is perceived yield instability and risks for lowering of grain quality (e.g. screenings and retention). Furthermore, decreasing row spacing can also impede trash flow which goes against production systems increasingly focussed on maximising stubble retention to maximise water use efficiency. Additionally, there are increases in costs for machinery with narrower rows and/or increased seed rates.

Recent research such as US00084, UWA0071/2, has also demonstrated changes in crop competitiveness through variety and crop choice that requires some further regional validation against standard district practices or commonly grown varieties. However, it can be argued seeding rates will be the most easily changed and more readily adopted by growers as opposed to reduced row spacing.

The proposed approach will focus on the impact on yield and grain quality of increasing crop competitiveness through seed rate and crop choice focusing on variety.

Aims

Investigate if increasing sowing rate impacts on yield and grain quality of a range of varieties common to the GOA region.

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Investigate any interactions between population and variety on crop biomass as a measure of crop competition

Methods

Trial Details							
Trial Establishment Date	Autumn 2020						
Sowing configuration	275 mm row spacing, KPPW						
Paddock history	2019 fallow		**Soil test**	Nitrogen (kg/ha)	Colwell P (ppm)	Sulfur (ppm)	
	2018 lucerne		0-10cm	58	24	7	
	2017 lucerne		10-90cm	242			
Sowing timings	Time of sowing		Harvest				
		11/5/2020	16/11/2020				
Varieties and Target plant pop (plant/m^2): a selection of quicker varieties to suit later sowing common to the region			Target plant population and sowing rate (kg/ha)				
	Variety	**Habit**	**30**	**70**	**110**	**150**	
	Beckom	Short plant type	11	27	47	72	
	Condo	Tall plant type	14	35	61	93	
	Coolah	Tall plant type	10	25	43	66	
	Mustang	Medium plant height	10	25	44	68	
	Scepter	Medium plant height	13	34	59	91	
	Spitfire	Medium plant height	14	37	64	99	
	Suntop	Tall plant height	14	37	65	99	
	Flanker	Tall plant height	15	38	66	100	
Trial design	Type: small plot (~12m x 2m) Design: split randomized block Replication: 4		Analysis ASREML – randomized complete block. Tested to a 95% confidence interval				
Treatment related observations and measurements	• Plant establishment • Vegetation index (2) NDVI • Grain yield and quality						

Results

Plant establishment: Increasing seeding rates increased established plant populations. For most varieties, establishment tended to be higher when the population of 70 and above were targeted. (Figure 1). In most cases each population established within each variety was significantly higher or lower than the other populations established, except for Suntop at 150 plants/m which was not different to 110 plants/m2.

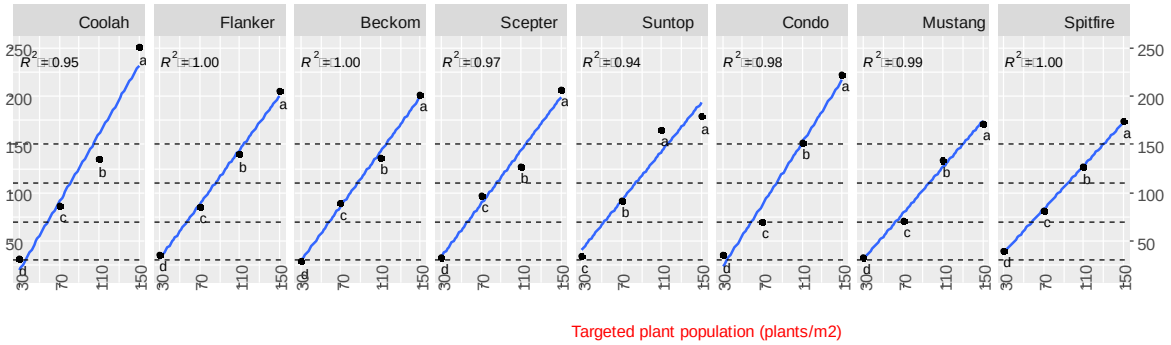

Figure 1. Plant establishment, actual against targeted, horizontal dashed lines are target of 30, 70, 110 and 150 plants/m2. Treatments with the same letter within a variety AND timing are not significantly different.

Vegetation Index: For all varieties vegetation index (VI) increased with plant population (**Figure 2**). Beckom and Mustang had lower early VI than other varieties. Condo and Spitfire had the highest VI at all populations.

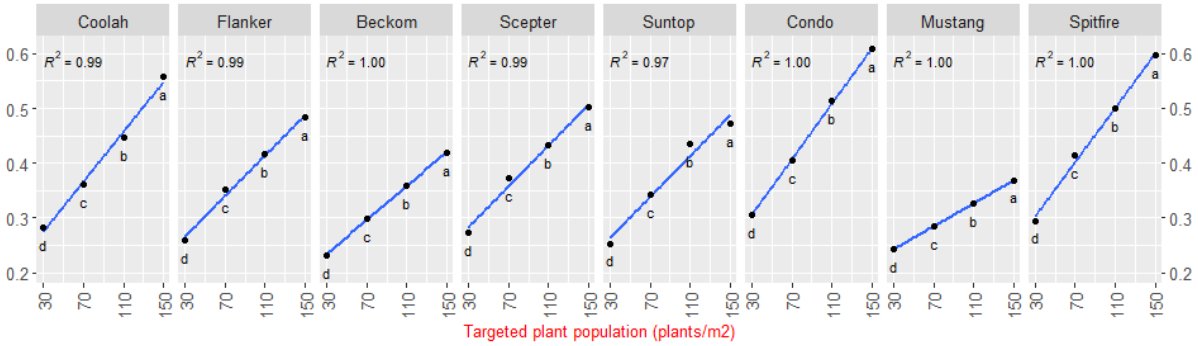

Figure 2. Vegetation index (NDVI) by variety and population (plants/m2). Treatments with the same letter within a variety AND timing are not significantly different. Assessed 49 days after sowing.

Yield: For 5 of the 8 varieties, increasing population had little or no effect on final yields, sowing at the higher rates decreased the yield of Coolah (**Figure 3**). Flanker and Scepter had the lowest yields at the 110 population. Spitfire did show a trend for yield to decrease with populations but it was not significantly different.

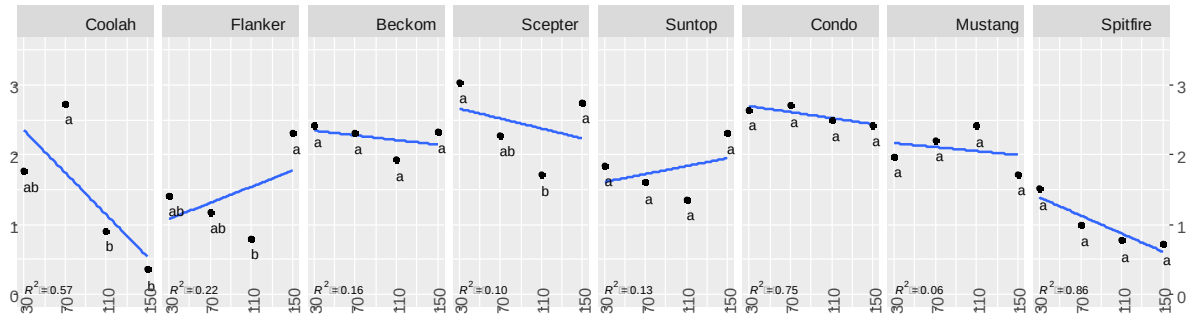

Figure 3. Yield (t/ha) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different.

Screenings: Flanker and Suntop had screenings increase at the highest population of 150 plants/m2 only. For the remining varieties, population had little effect on screenings (Figure 4).

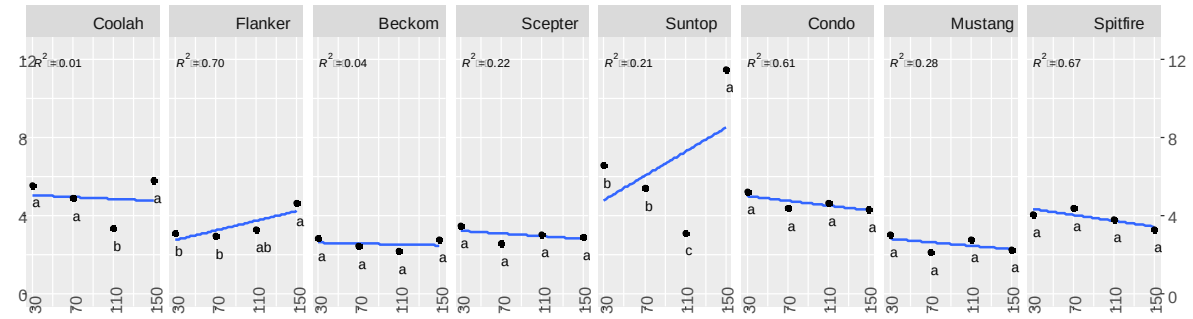

Figure 4. Screenings (%) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different.

Discussion

Increasing populations increased the vegetation index (which may be considered a proxy for crop competition) regardless of variety. For the varieties and the populations tested this tended to be a linear relationship. This suggests that growers may consider increasing sowing rates of their existing varieties to increase populations and increase weed competition.

These was a considerable difference between varieties in early season vigour. And growers with problem weed paddocks may consider switching to a variety that displays higher levels of early vigour to compete against weeds.

Most varieties had relatively stable yields across populations as were screenings maybe with the exception of Suntop at the highest populations. Crown rot disease was present at the site however test results did not show any clear correlation between disease levels and yields or grain quality. Varietal choice had a bearing on both yield and screenings.

Increasing populations had little bearing on screenings, and this appeared to be more variety driven.

Conclusions

Increasing sowing rates in all varieties tested this would likely increase crop competition.

Some varieties display higher levels of crop competition at the same population and growth stage.

Increasing sowing rates did not negatively impact yields or grain quality in terms of screenings. In fact, evidence in this trial suggests quite the opposite, yields improved, and screening decreased with higher sowing rates.

Acknowledgements

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DISCLAIMER — TECHNICAL

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Appendix

Variety	Target population	Plant establishment (plants/m2)			Vegetation index (June)			Yield (t/ha)			Screenings (%)		
		p.v.[1]	s1[2]	s2[3]	p.v.[1]	s1[2]	s2[3]	p.v.[1]	s1[2]	s2[3]	p.v.[1]	s1[2]	s2[3]
	Beckom												
	30	28.8	j	d	0.23	p	d	2.4	abcd	a	2.8	klm	a
	70	89.4	hi	c	0.30	klm	c	2.3	abcde	a	2.4	lm	a
	110	136.4	fg	b	0.36	i	b	1.9	abcdefgh	a	2.2	m	a
	150	202.1	bc	a	0.42	fgh	a	2.3	abcde	a	2.8	klm	a
	Condo												
	30	35.2	j	d	0.30	kl	d	2.6	abc	a	5.2	cde	a
	70	70.0	i	c	0.40	h	c	2.7	ab	a	4.4	cdefghi	a
	110	152.1	ef	b	0.51	c	b	2.5	abcd	a	4.6	cdefg	a
	150	222.7	b	a	0.61	a	a	2.4	abcd	a	4.3	defghi	a
	Coolah												
	30	31.2	j	d	0.28	lmno	d	1.8	bcdefghi	ab	5.6	bc	a
	70	87.0	hi	c	0.36	i	c	2.7	ab	a	4.9	cdef	a
	110	134.5	fg	b	0.45	ef	b	0.9	ghi	b	3.4	ghijklm	b
	150	250.7	a	a	0.56	b	a	0.4	i	b	5.8	bcd	a
	Flanker												
	30	36.1	j	d	0.26	nop	d	1.4	cdefghi	ab	3.1	jklm	b
	70	85.5	hi	c	0.35	ij	c	1.2	efghi	ab	3.0	jklm	b
	110	139.7	fg	b	0.42	gh	b	0.8	ghi	b	3.3	hijklm	ab
	150	205.1	b	a	0.48	cd	a	2.3	abcdef	a	4.6	cdefgh	a
	Mustang												
	30	33.6	j	d	0.24	p	d	2.0	abcdefg	a	3.0	jklm	a
	70	71.2	i	c	0.28	lmn	c	2.2	abcdef	a	2.1	m	a
	110	133.6	fg	b	0.33	jk	b	2.4	abcd	a	2.8	klm	a
	150	172.1	de	a	0.37	i	a	1.7	bcdefghi	a	2.2	m	a
	Scepter												
	30	33.0	j	d	0.27	mno	d	3.0	a	a	3.5	ghijkl	a
	70	97.6	h	c	0.37	i	c	2.3	abcde	ab	2.6	klm	a
	110	127.6	g	b	0.43	fgh	b	1.7	bcdefghi	b	3.0	jklm	a
	150	207.0	b	a	0.50	cd	a	2.8	ab	ab	2.9	jklm	a
	Spitfire												
	30	39.7	j	d	0.29	lm	d	1.5	bcdefghi	a	4.1	efghij	a
	70	81.5	hi	c	0.41	gh	c	1.0	fghi	a	4.4	cdefghi	a
	110	126.7	g	b	0.50	cd	b	0.8	ghi	a	3.8	fghijk	a
	150	174.2	d	a	0.60	a	a	0.7	hi	a	3.3	hijklm	a
	Suntop												
	30	34.2	j	c	0.25	op	d	1.8	abcdefghi	a	6.6	b	b
	70	92.0	hi	b	0.34	ij	c	1.6	bcdefghi	a	5.4	bcd	b
	110	165.5	de	a	0.43	fg	b	1.4	defghi	a	3.1	ijklm	c
	150	178.8	cd	a	0.47	de	a	2.3	abcdef	a	11.4	a	a
	lsd	22.1			0.03			1.3	na	na	1.3		

[1] predicted value
[2] values with the same letter for each variable are not significantly different
[3] values with the same letter for each variable within each VARIETY only are not significantly different